JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES
VOL. 11 DECEMBER 19, 1921 No. 21

ZOOLOGY.—*A key to the Philippine operculate land mollusks of the genus* Ceratopoma.[1] PAUL BARTSCH, United States National Museum.

In 1918 we published in this JOURNAL[2] a *Classification of the Philippine operculate land shells of the family Helicinidae, with a synopsis of the species and sub-species of the genus Geophorus.* In that paper we gave keys to the subgenera and species of the largest genus, namely, *Geophorus*, of the subfamily Helicinidae. Since then enough material has come to hand to enable us to similarly treat another genus, namely, that of *Ceratopoma*, a key to the species of which is herewith furnished (see page 502).

Ceratopoma has the operculum less specialized than any other Philippine Helicinid. It consists of a simple, horny shell without calcareous deposit. The type of the genus is *Helicina caroli* Kobelt.

The animal, like *Geophorus*, is usually a ground dweller and may be found among dead leaves as well as in crevices of rocks. At the present time the genus is known from Luzon, Leyte, Siargao and northeastern Mindanao, and it is quite possible that careful collecting in the islands between the two extremes will reveal additional species.

Ceratopoma caroli Kobelt comes from the island of Siargao. It is a large species, with the parietal callus chestnut brown. In fact, it is the only *Ceratopoma* so far known with a brown callus.

Ceratopoma henningiana Möllendorff was described from Pena Blanca, Luzon, and differs from all the other *Ceratopomas* in having a broad brown basal band near the periphery.

Ceratopoma cagayanica, sp. nov., differs from the other two known large non-color-banded *Ceratopomas* in having the peripheral keel limited on the base by an incised line, in which character it agrees with *Ceratopoma henningiana* Möllendorff. The type, Cat. No.

[1] Published by permission of the Secretary of the Smithsonian Institution. Received November 8, 1921.

[2] This JOURNAL 8: 643–657. 1918.

KEY TO THE PHILIPPINE SPECIES OF CERATOPOMA

Shell large, greater diameter more than 13 mm.
- Parietal callus chestnut brown ..... *caroli* Kobelt
- Parietal callus not chestnut brown
  - Peripheral keel limited on the base by an incised line
    - Base with a brown peripheral band ..... *henningiana* Möllendorff
    - Base without a brown peripheral band ..... *cagayanica* Bartsch
  - Peripheral keel not limited on the base by an incised line
    - Umbilical callus about one-half of the diameter of the shell ..... *emaculata* Möllendorff
    - Umbilical callus not one-half of the diameter of the shell
      - Umbilical callus about one-fourth of the diameter of the shell .... *emaculata cabaliana* Bartsch

Shell small, greater diameter less than 8 mm.
- Shell subglobose[1]
- Shell not subglobose
  - Shell depressed conic
    - Upper surface strongly spirally striated ..... *contermina* (Semper) Kobelt
      - Greater diameter 6 mm ..... *contermina contermina* (Semper) Kobelt
      - Greater diameter 4.9 mm ..... *contermina iota* Bartsch
    - Upper surface not strongly spirally striated
      - Upper surface without spiral sculpture on the later whorls ..... *rosaliae* Pfeiffer
        - Greater diameter 7.6 mm ..... *rosaliae rosaliae* Pfeiffer
        - Greater diameter 6.7 mm ..... *rosaliae manilana* Bartsch
        - Greater diameter 5.7 mm ..... *rosaliae igorota* Bartsch

[1] The mollusk described by Wagner as *Ceratopoma contermina camiguinensis* from Camiguin, Luzon, should come near here, but I have not seen specimens of it, and therefore am unable properly to key it.

302763, U. S. N. M., comes from Cagayan, Mindanao. It has 4.5 whorls and measures: altitude, 7.5 mm.; diameter, 13.5 mm.

Two forms of *Ceratopoma* are known from the island of Leyte, one having the umbilical callus about half the diameter of the shell, which is *Ceratopoma emaculata* Möllendorff, the other having the umbilical callus only about one-fourth the diameter of the shell, which may be known as **Ceratopoma emaculata cabaliana,** subsp. nov. The former we collected in the mountains south of Tacloban, Cat. No. 258771, U. S. N. M. The latter comes from Sitio Menoiho, Cabalian, Leyte. The type is Cat. No. 302741, U. S. N. M.

The remaining members of the genus are all from the island of Luzon, and are small, none exceeding 8 mm. in diameter. Two of these have a subglobose outline, namely, *Ceratopoma quadrasi* Möllendorff, which comes from Caxiguran, and the shell described by Wagner as *Ceratopoma contermina camiguinensis* from Camiguin, Luzon. The latter I have not seen, and consequently have not placed in the key. The figure given by Wagner resembles that of *Ceratopoma quadrasi*, but from what we know of the distribution of *Helicinas* there seems little doubt that it is distinct, and if specimens were at hand characters could be given to key it.

The remaining forms are depressed-conic, and can be divided into two species, one having the upper surface strongly spirally striated. This is *Ceratopoma contermina* (Semper) Kobelt, which was described from Pancian, northern Luzon, and has a diameter of more than 6 mm., and a smaller race, which may be called **Ceratopoma contermina iota,** subsp. nov., from Cagayan, Luzon. The type of this, Cat. No. 302758, has $4^1/_3$ whorls and measures: altitude, 3.2 mm.; greater diameter, 5.6 mm. The other species, *Ceratopoma rosaliae* Pfeiffer, is without spiral striation on the upper surface. The typical form we have seen from the eastern side of Isabella and Nueva Viscaya Provinces, Luzon.

A smaller race occupies the Manila Bay region, to which we now give the name **Ceratopoma rosaliae manilana,** subsp. nov.. The type, Cat. No. 184924, U. S. N. M., comes from Manila. It has $4^1/_3$ postnuclear whorls and measures: altitude, 3.8 mm.; diameter 6.7 mm.

A still smaller race comes from the Benguet Province which we have called **Ceratopoma rosaliae igorota,** supsb. nov., the type of which has $4^1/_4$ whorls and measures: altitude, 3.2 mm., diameter, 5.7 mm.

ZOOLOGY.—Marionella (Eurystoma *Marion*, 1870); *an emendation, with notes on a new birefringent substance, marionellin, found in the intestinal cells.* (*Contributions to a science of Nematology*, XI.)[1] N. A. COBB, U. S. Department of Agriculture.

The name *Eurystoma*, applied by Marion[2] in 1870 to a new genus of free living marine nemas discovered by him near Marseilles, France, was preempted, having been applied by Rafinesque in 1818 to a genus, of molluscs. Naturally, investigations, made during the last half century enable one, at the present time, to emend Marion's original description. Having examined as many more new, and as yet unpublished, species of the genus as have been already published, I venture to make this emendation, based on a study of about twenty-five species, and to propose for the genus the new name *Marionella*, in commemoration of its original author.

Marionella, nom. nov.

Eurystoma Marion, Ann. Sci. Nat. Zool. V. **13**: 19. 1870. Not *Eurystoma* Raf. 1818.

Cuticle and setae.—The thin layers of the transparent, colorless cuticle are traversed by transverse striae so exceedingly fine that they are very difficult to see even with highest powers of the microscope. Occasionally oblique striae also are to be seen in the cuticle of the lips, running in the direction of a left-handed screw. There are no lateral wings to the cuticle, and the striae are not altered on the lateral fields. There are no longitudinal striae in the cuticle itself, but the attachments of the somatic muscles give rise to longitudinal markings of a character somewhat resembling true striae. The contour of the body is always plain.

The cephalic setae, which are one-third to two-thirds as long as the lip-region is wide, are six or ten in number. Even when at first sight there appear to be only six, it is frequently found that in reality there are ten,—each of the four submedian setae having a very short and very inconspicuous companion hugging its base. The setae, two lateral and four or eight submedian, are usually slightly curved, of medium size to very slender, tapering, and somewhat acute, and have innervations that are most clearly visible near their bases; they are of medium stiffness to flexible, and spread outward from the lateral surface of the head opposite the apex of the onchium. Occasionally the larger setae *can be seen to be about three-jointed.* There are no special subcephalic setae. On the anterior portion of the neck in the vicinity of the head there are always to be found a few small, slender setae, one-sixth to one-eighth as long as the corresponding body-diameter; these usually project at right angles to the neck or incline forward at an angle of sometimes as much as forty-five degrees. Not infrequently among the cervical setae there is one, a dorsal one, two to three times as far back as

[1] Received November 10, 1921.

[2] Ann. Sci. Nat. Zool. V. 13: 19. 1870.

the base of the head, which is more prominent than the others. The somatic setae appear always to be reduced to innervations. There are no conspicuous pores on the surface of the body, but the ellipsoidal glandular cells of considerable size invariably found in the lateral fields are connected with the exterior by means of *very small and inconspicuous pores*.

Head and pharynx.—The somewhat rounded to subtruncate head is usually continuous with the neck, but is sometimes set off by a slight contraction, or by a very slight, broad, shallow constriction. The lip-region, on the other hand, is nearly always set off by a very slight, narrow and shallow, but usually distinctly visible constriction. The membranous lips are themselves thin and confluent, and apparently close by virtue of their elasticity. Their margins are very finely striated and possibly sometimes fimbriate. The lips are supplied externally with six forward-pointing papillae (or six sets of papillae), arranged in a single circlet having a diameter about one-half as great as that of the lip-region. These papillae are so exceedingly small as usually to escape observation. Their innervations are also exceedingly inconspicuous. Usually it is only when the papillae happen to project forward a little in exact profile that they come into view.

At first sight the pharynx appears to have the form of that of *Oncholaimus*. It is, however, nearly always *divided into two distinct chambers* of more or less equal length, the anterior of which is somewhat the wider and the more symmetrical. This regular anterior chamber is nearly always a napiform cavity one-half to two-thirds or even three-fourths as wide as the corresponding portion of the head. The posterior chamber is of smaller size, usually only about three-fourths as wide as the anterior chamber, and more or less irregularly spheroidal in form. The refractive walls of the pharynx are well-developed, but not very thick. The pharynx is usually armed with a single *well-developed, forward-pointing onchium*, but there may be one or two additional smaller onchia in exceptional cases. The apex of the main, and usually only, onchium, always occupying the right ventral submedian position, extends forward sometimes as far as the lips. The convex-conoid, enlarged base of the onchium fills the posterior chamber of the pharynx comparatively full. This enlarged portion of the onchium is continued in the front chamber by a narrower, more slowly tapering, convex-conoid, more or less acute summit. This organ is perforated and so serves as the *outlet of a large oesophageal gland*. The posterior pharyngeal chamber is separated from the anterior by a constriction, marked in its most pronounced form by the presence of narrow and refractive, transverse, arcuate elements or thickenings, placed end to end in a circle. Adjacent to this circle, usually in front of it and close together, there are one to three *transverse rows of denticles*, each consisting of either about thirty-two, or about sixty-four to eighty, somewhat forward-pointing units. These more or less inward pointing denticles are rather acute, cylindroid-conoid, uniform in size, and are usually so minute as to be barely resolvable with high powers of the microscope.

When viewed from in front, the pharynx is seen to be very nearly round. The margin of the lip-region is so thin and filmy that oftentimes it is difficult to delimit. An exact count of the denticles in a specimen of an unpublished but typical species, gave the following figures:—anterior series of denticles 62; second series 62; back series of larger denticles 20;—this decreased number in the back row being due not only to the fact that the denticles are larger

and farther apart, but also to fact the that one-third of the circumference is destitute of denticles, namely that part of the circumference opposite the large onchium. In this particular region, however, the interior walls of the pharynx are very finely longitudinally striated. The back row of denticles, it should be pointed out, is on the wall of the posterior half of the pharynx.

The neck is conoid, or occasionally subcylindroid, and ends in a cylindroid or, more often, a rather decidedly convex-conoid head.

Amphids and eye-spots.—Though the *amphids are well-developed*, they are rarely plainly to be seen. Their exterior expression consists of *two dorsally sub-lateral concavities* two to three times as wide as long, impinging on the bases of the lateral setae. Though the peripheries of the amphids may seem to be closed, they are, in fact, nearly always found to be open on the posterior margin near the lateral fields. As a rule their contours are almost invisible, so that their form and extent are mainly indicated by the apparent absence in them of the fine structural elements to be seen elsewhere in the cuticle of the head. When clearly defined, their contours are found to be reniform with the convex side forward. They are located on or near the base of the lip-region, and more or less opposite to the rows of denticles. They are usually one-third to two-fifths as wide as the corresponding diameter of the lip-region and two to three times as wide as long.

More often than not two eye-spots are present. These take the form of spheroidal, compact collections of about one hundred brownish granules, each collection lateral in position and lying between the oesophagus and body-wall,—being about one-fourth as wide as the corresponding portion of the neck, and removed from the anterior extremity by a distance two to four times as great as the width of the head. Anteriorly, these ocelli often present a spherical cavity in which there is at least the suggestion of a spherical lens.

Oesophagus.—The simple conoid oesophagus is destitute of bulbs and receives the base of the pharynx in its anterior extremity, where it is usually about half as wide as the base of the head. Near the nerve-ring it is usually about one-half, and posteriorly usually about three-fifths, as wide as the corresponding part of the neck. It is always separated from the intestine by a distinct cardiac collum about one-third as wide as the base of the neck. While not conspicuous, the lining of the oesophagus is a distinct feature throughout its length. Though the oesophageal musculature is usually fine, the structure is occasionally coarse in the posterior part. Rarely, yellowish spherical granules are found in the tissues of the oesophagus. The oesophageal glands are well-developed, or at least one of them is; as before stated, they empty into the pharynx through pores in the onchia. The right submedian gland is without exception the largest. There is usually a well-developed conoid or hemispherical cardia one-third to one-half as wide as the corresponding portion of the neck.

Intestine.—The intestine becomes at once one-half to two-thirds as wide as the body, and is made up of cells of such a size that few are required to build a circumference. Its walls are thick, and its lumen faint. Its cells invariably contain fine spherical granules of more or less variable size, the largest of them being one-fortieth to one-twentieth as wide as the body. The granules are scattered, or sometimes numerous, in the cells, and may be so arranged as to give rise to a faint tessellated effect, though this is unusual.

Doubly refractive granules (Marionellin) in the intestinal cells.—In the single layer of cells composing the intestine, an undescribed species of *Marionella* presented about twenty scattered special cells, more numerous and closer together anteriorly, each packed with doubly refractive granules (marionellin) mostly of very small size. Marionellin occurs in other species of *Marionella*.

These special intestinal cells were not distributed along a definite longitudinal line as in *Ironus*, where there is a decided dorso-ventral symmetry to the intestine due to the dorsal cells having a different character from the ventral. The interspaces between these special cells in this species of *Marionella* increased rather regularly from front to rear.

The discovery of these special intestinal cells is an additional observation *indicating differentiation among the cells of the nema intestine.* Such differentiated cells are now known to the writer in the following genera, among others: *Enoplus, Bathylaimus, Ironus, Mononchus, Eurystoma* (all carnivorous). It seems very reasonable to suppose that these differentiated cells may have functions similar to those of the glands accessory to the intestine of other and larger animals. Assuming that digestion in nemas has a general similarity to that of the higher animals, it would seem that gastric, hepatic, renal and other functions must exist in some form in the nema; thus far, however, very few of these functions can be assigned to special organs, as few or no such special organs exist. Instead of each cell of the intestine carrying out all of these distinct functions, in view of the above observations there is now morphological evidence of *"division of labor," and when these differentiated cells have been adequately investigated, we shall probably be able to assign to them definite functions*, and, for illustration, be able to apply to them some such terms as "hepatic cells," "renal cells," "spleenic cells," etc.

Tail.—The tail in *Marionella* takes on one of two distinct forms, according as there *is or is not a spinneret present.* If there is no spinneret the tail is conoid from the anus to the acute terminus, sometimes however tapering a little more rapidly in the anterior portion than elsewhere. In species possessing this form of tail, usually the tail of the male is the shorter, and the narrow conoid posterior part may appear rather as an appendage to the short but bulky anterior part. Most of the species, however, possess *three well-developed unicellular caudal glands* and a blunt, conoid, unarmed, and symmetrical terminal spinneret about one-fourth as wide as the base of the tail. If any setae occur on the tail, they are exceedingly small and very inconspicuous. The three quite separate ducts of the caudal glands are plainly visible in the tail and end posteriorly in three separate ampullae. The unicellular glands themselves are arranged in a loose tandem in front of the anus, the foremost being removed a distance from the anus several times as great as the corresponding body diameter.

Lateral fields: glandular cells.—The lateral fields are usually about half as wide as the body, and contain large, granular, ellipsoidal, *glandular cells* about one-third as wide as the body and emptying on the surface of the cuticle by means of exceedingly *minute pores.* These large glandular cells are situated from point to point throughout the length of the body, the distance between them being from one to four times as great as the width of the body

Renette.—The renette cell is invariably situated behind the neck and empties by means of a long, narrow, faintly visible duct. The narrow in-

conspicuous ampulla is situated nearly opposite the base of the pharynx. The obscure *excretory pore is invariably located in the lip-region* opposite the row of cephalic setae. The presence of the duct and ampulla usually causes the pharynx as well as the portion of the oesophagus near the head to be a little nearer to the dorsal side of the body than to the ventral.

Nerve-ring.—The nerve-ring is always a rather conspicuous feature. As a distinct collar it surrounds the oesophagus a trifle obliquely and is of medium size, and has arranged both in front of it and behind it numerous large nuclei, whose grouping, however, does not appear to be very orderly.

Female organs.—The female sexual organs are *invariably double and reflexed* ('f'). The vulva, though large, is more or less continuous and not very conspicuous. The well-developed vagina leads inward at right angles to the ventral surface about two-fifths of the way across the body, and, though fairly muscular, is not very amply cutinized.

The two straight uteri are of such a size as to contain two or more eggs at a time, arranged tandem; these latter are thin-shelled, smooth, usually ellipsoidal or somewhat elongated, and are deposited before segmentation begins. The reflexed ovaries are broad, or of medium width, taper more or less, and extend one-half to two-thirds the distance back to the vulva. The ova in them are arranged single file except near the blind end, where they are arranged irregularly.

Male organs.—The tail of the male is like that of the female except that it is usually shorter and more pronounced in its features, especially in species lacking a spinneret. In all the species that have been carefully examined in this respect, namely in the majority of the species, there are *two outstretched testes* extending in opposite directions, the anterior one ending a neck-length or more behind the cardia, the other near the beginning of the posterior fourth of the body. The two equal spicula are invariably arcuate, and occasionally strongly so. At their widest part they are one-sixth to one-eighth as wide as the corresponding portion of the body. They are from one and one-fourth to two times as long as the anal body diameter, and when viewed in profile their proximal ends appear to lie opposite to or slightly dorsad from the body axis,—very rarely ventrad. The proximal ends are almost always very slightly cephalated by expansion, but they are sometimes faintly cephalated by constriction or by contraction. They are somewhat slender, of rather uniform width, and rather blunt at the free end, where they sometimes terminate in a simple or denticulate crochet. The gubernaculum, placed at right angles to the distal parts in the spicula, though sometimes of uniform width, usually tapers internally to a blunt or acute point, which lies opposite to or dorsad from the body diameter. From this apophysis muscles lead fore and aft to the dorsal body wall. The portion of the gubernaculum applied to the spicula is one-sixth to one-eighth as long as these latter.

Supplementary organs.—Invariably *two large, ventral, pre-anal supplementary organs are present,* though in a few species they are more or less vestigial. They are placed in front of the anus in such fashion that the posterior one is about as far in front of the anus as the spinneret is behind it, and the anterior one about as far in front of the posterior as this latter is in front of the anus. There is, however, some variation in the situation of this pair of supplementary organs in the different species. Nearly always the posterior supplement is a little smaller than the anterior, some-

times markedly so. When well-developed, these organs consist of highly refractive elements, both external and internal, which are *very striking in their appearance*. To a considerable extent these supplements can be *protruded and withdrawn*. When protruded they are very prominent. When withdrawn they may leave the ventral contour comparatively even; and yet, even when withdrawn, they are hardly less conspicuous than when protruded, owing to their highly refractive character. The most striking internal elements are two in number to each supplement, extending, one forward and the other backward, and may *appropriately be termed "levers."* These levers are somewhat finger-shaped pieces of cutinized material that serve for the attachment of muscles. They usually taper but little, and their internal extremities are invariably blunt. The two levers of a given supplement are usually practically equal in size. When the supplement is at rest, the levers lie near the ventral side of the body and parallel to it. In such circumstances the exterior portion of the organ protrudes only slightly; but when the free inner ends of the levers are drawn inward so that they lie at an angle with the ventral surface, sometimes as great an angle as forty-five degrees, the external portions of the supplements are protruded. The external portion of each organ has the form of a laterally compressed cup, or trough, whose profile is exteriorly flat, or more often slightly concave, and interiorly more or less semi-circular. While the depth of the organ may sometimes equal its width, often it is less, and sometimes only one-half or one-third as great. Those species showing the maximum development of the supplementary organs present cases where the depth of the organ is one-fourth as great as the corresponding diameter of the body. In one species the supplementary organs are asymmetrical, the anterior lever or anchor having become vestigial, and the anterior portion of the cup or trough having diminished relatively in size, so that the contour of the longitudinal section of the organ is triangular rather than semicircular. By means of a duct each supplementary organ is *connected internally and forward with a large glandular cell*, as in *Bolbella*.

Setae on the male.—Just in front of the anus on the male there are usually to be found a few minute setae, either ventral or subventral in position. They are very short and very inconspicuous. There may be a single one at the anus; more often there are one or two subventral ones on each side. Occasionally there are two rows extending to near the posterior supplement. These setae are arcuate, acute, and when two are present on each side of the anus, one of the pair is usually located immediately behind the other and is of smaller size. No other papillae or setae have been observed on the tail end of the male. There is no bursa.

Habitat.—The genus *Marionella* has hitherto been supposed to be of rather small size. It is in reality large, and is widespread in the various oceans. While the individuals of a given species may not be numerous, or very widespread, the number of specific forms observed is yearly augmenting. The two sexes are about equally common.

The genus is most nearly related structurally to *Bolbella*, *Symplocostoma*, *Thoönchus* and *Catalaimus*.

Marionella spectabilis (Marion) is still retained as the type species.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. The abstracts should conform in length and general style to those appearing in this issue.

GEOLOGY.—*Geology of the Cement oil field, Caddo County, Oklahoma.* FRANK REEVES. U. S. Geol. Surv. Bull. **726-B.** Pp. 45 (41–85). 1921.

It has long been believed that the region of tilted strata which borders the Wichita Mountains should contain local anticlines favorable for the accumulation of oil and gas. The pronounced anticline at Cement and anticlinal folds at Lawton and to the south in Cotton County support this belief. The production of oil at Cement proves not only that the structure at that locality is of the type favorable for oil accumulation but that there are adequate reservoir beds and a source of petroleum.

The area lies about 15 miles northeast of the Wichita Mountains, in the Permian "Red Beds" plain, which encircles the Wichita uplift and out of which the mountains rise "like islands in a sea."

The surface rocks of the Cement field and about 1,500 feet of the underlying beds are regarded by the writer as of Permian age. They consist of red and blue shales, red and gray sandstone, gypsum, and limestone.

The geologic structure is described and its relation to the accumulation of oil is discussed.

The oil produced so far in this field has come from a series of shales and sandstones, which underlies the surface at depths of 1,500 to 2,400 feet.

The paper concludes with recommendations as to future development and copies of drillers' logs of wells. R. W. STONE.

GEOLOGY AND HYDROLOGY.—*Ground water in the Norwalk, Suffield, and Glastonbury areas, Connecticut.* HAROLD S. PALMER. U. S. Geol. Surv. Water-Supply Paper **470.** Pp. 171, pls. 12, figs. 18. 1920.

This paper is the third to appear of a series of detailed reports on the ground water resources of selected areas in Connecticut. The first part of the report is of a general character and treats of the water-bearing formations, occurrence and recovery of ground water, and its quality. This is followed by descriptions of the thirteen towns included in the three areas.

Almost everywhere small quantities of water may be obtained from fissures and joints in the bed rocks which include igneous and metamorphic rocks of pre-Triassic age, and sandstone, shales, and traps of Triassic age. In the upper levels the bed rock is overlain by till which in general yields satisfactory domestic supplies. The deposits of stratified glacial outwash in the lowlands yield abundant supplies of water.

For each of the three areas there is given a geologic map showing the distribution of the various water-bearing formations, and a map showing the distribution of woodlands and the locations of the wells and springs referred to in the tables in the body of the report. H. S. P.

HYDROLOGY.—*Water supply of St. Mary and Milk Rivers, 1898–1917.* B. E. JONES AND R. J. BURLEY. U. S. Geol. Surv. Water-Supply Paper **491.** Pp. 583, pls. 26. 1920.

This report is a compilation of all stream-flow data collected in 1898–1917,

at both the international and national stations in the Milk and St. Mary River basins (Montana and Canada). It was prepared under the direction of the United States Geological Survey, the United States Reclamation Service, and the Reclamation Service of Canada. Most of the records assembled appear as originally published in reports of the Reclamation Service of Canada and the United States Geological Survey, but some have been revised. Tables of daily discharge not heretofore published have been taken from the original records. The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off. Hydrographs are given for 13 stations. N. E. DOWELL.

PALEONTOLOGY.—*American species of* Operculina *and* Heterostegina *and their faunal relations.* JOSEPH A. CUSHMAN. U. S. Geol. Sur. Prof. Paper **128-E:** 125–131, pls. 18–21. 1921.

Before 1915, the presence of nummulites in the upper Eocene limestone of central Florida was thought to distinguish that rock, to which the name Ocala limestone was applied, from the otherwise similar "Peninsula limestone." Latterly, nummulitic Foraminifera have been found at many places in the much wider area in Florida, Georgia, and Alabama throughout which the Ocala limestone as now defined extends.

Besides Heilprin's two species *Nummulites willcoxi* and *N. floridensis*, which are now referred to the closely related genus *Operculina*, Doctor Cushman describes and figures three new species of *Operculina* and one new species and variety of *Heterostegina* from the Ocala limestone. *Nummulites antillea* Cushman, from limestone of the same age as the Ocala in the island of Saint Bartholomew, is referred to *Operculina*. A previously described species of *Heterostegina, H. antillea*, comes from the Oligocene of Antigua, St. Croix. and Santo Domingo. C. WYTHE COOKE.

PALEONTOLOGY.—*A new species of* Orthophragmina *from Louisiana.* JOSEPH AUGUSTINE CUSHMAN. U. S. Geol. Sur. Prof. Paper **128-E:** 139, pl. 22. 1921.

This short paper, which is supplementary to the author's "The American Species of Orthophragmina and Lepidocyclina," describes and figures *Orthophragmina advena* Cushman from the St. Maurice formation (lower Claiborne Eocene) of Natchitoches, La. C. WYTHE COOKE.

ORNITHOLOGY.—*Descriptions of apparently new South American birds.* W. E. CLYDE TODD. Proc. Biol. Soc. Wash. **33:** 71–76. 1920.

Study of the material obtained from recent explorations in French Guiana, the lower Amazon, and the Santa Marta region has resulted in the discovery of further new birds which are here described. The three new species are: *Polioptila guianensis*, from French Guiana; *Myrmopagis paraensis*, from Brazil; and *Nyctipolus maculosus*, from French Guiana. The thirteen new subspecies are as follows: *Myospiza aurifrons meridionalis*, from Bolivia; *Brachyspiza capensis argentina*, from Argentina; *Volatinia jacarini atronitens*, from Mexico; *Sublegatus glaber obscurior*, from French Guiana; *Sayornis latirostris fumigatus*, from Colombia; *Sirystes albocinereus subcan-*

escens, from Brazil; *Cercomacra tyrannina laeta*, from Brazil; *Formicarius ruficeps orinocensis*, from Venezuela; *Sclerurus rufigularis fulvigularis*, from French Guiana; *Microxenops milleri guianensis*, from French Guiana; *Furnarius leucopus exilis*, from Colombia; *Dendrocolaptes certhia medius*, from Brazil; and *Veniliornis oleaginus exsul*, from Colombia.

H. C. OBERHOLSER.

ORNITHOLOGY.—*Diagnoses of some new genera of birds.* ROBERT RIDGWAY. Smith. Misc. Coll. **72**[4]: 1–4. 1920.

In the course of investigations of North American birds, several new genera have been brought to light and are here characterized. Four of these belong to the Buteonidae, as follows: *Oroaetus*, type, *Falco isidori* Des Murs; *Phaeoaetus*, type, *Falco limnaetus* Horsfield; *Morphnarchus*, type, *Leucopternis princeps* Sclater; and *Percnohierax*, type, *Falco leucorrhous* Quoy and Gaimard. Three others are included in the Rallidae: *Hapalocrex*, type, *Rallus flaviventris* Boddaert; *Limnocrex*, type, *Prozana cinereiceps* Lawrence; and *Thryocrex*, type, *Corethrura rubra* Sclater and Salvin.

H. C. OBERHOLSER.

ORNITHOLOGY.—*Washington region* [*October and November, 1919*]. H. C. OBERHOLSER. Bird Lore **22**: 47–48. 1920.

The mild weather of October and November, 1919, apparently induced a large number of birds to remain considerably beyond their former records in the vicinity of Washington. Details are given for a number of species.

H. C. O.

ORNITHOLOGY.—*Federal and State game preserves.* E. W. NELSON. Bull. Amer. Game Protect. Assoc. **9**[2]: 6–8. 1920.

Draining of the lakes and marshes is one of the most serious dangers that now threaten our waterfowl. These bodies of water in their original state have as great value as if converted into farm lands, since their annual output of game, fish, and fur-bearing animals will yield as great monetary return as the crops that might be raised on the same land. Furthermore, the presence of such areas throughout the country will have in addition to this monetary return a high recreational value. In many States the preservation of these lands in their original condition is now the most urgent need in wild life protection, particularly in the conservation of wild fowl, since the elimination of their breeding grounds means the disappearance of the birds. More refuges should be established like those already under the jurisdiction of the State and Federal governments. Likewise, public shooting grounds and refuges should be increased in number in the national forests.

H. C. OBERHOLSER

ORNITHOLOGY.—*The crow in its relation to agriculture.* E. R. KALMBACH. U. S. Dept. Agric., Farm. Bull. **1102**: 1–20. 1920.

The present report is a resumé of the data and conclusions presented in a prior and more extensive bulletin. From the evidence available it is apparent that the crow, while unfavorably influencing man's interests by its raids on the poultry yard, its depredations on wild birds, and its attacks on crops, is at the same time of important economic assistance by reason of its warfare on insects. It is, therefore, evident that while it would be unwise to give the crow absolute protection, it would be equally unfortunate to adopt a policy of extermination. H. C. OBERHOLSER

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY

854TH MEETING

The 854th meeting of the Philosophical Society of Washington was held in the Cosmos Club auditorium on October 22, 1921. It was called to order at 8:15 p.m. by President FARIS with 45 persons present.

The first paper of the evening, on *Sky brightness and daylight illumination measurements*, was presented by Mr. H. H. KIMBALL, and was illustrated. It was discussed by Mr. HUMPHREYS.

The brightness of the sky has been measured almost daily at the American University, Washington, D. C., between April 5 and July 14, inclusive, and at Chicago, Illinois, between July 19 and August 15, inclusive, 1921.

The illumination from sunlight and skylight combined, and from skylight alone, was measured on a horizontal surface, and also on a surface normal to the incident solar rays; and at Washington, measurements were obtained of the skylight illumination on vertical surfaces facing 0°, 45° 90°, 135°, and 180° in azimuth from the sun.

About half the Chicago measurements were made on top of the dome of the Federal Building, in the Loop district, one of the smokiest sections of the city. The remainder were made at the University of Chicago, which in summer is comparatively free from smoke when the wind blows from the lake. Southeast and southwest winds, however, bring considerable smoke from South Chicago and the Union Stockyards, respectively.

There is little smoke in the atmosphere at the American University, D. C.

A comparison of the Washington and Chicago measurements shows that towards the sun on cloudless days the sky brightness does not differ materially at the two places, but opposite the sun the horizon in Chicago is darkened by smoke, especially in the Loop district.

With a cloudless sky the direct solar illumination at Chicago is noticeably weaker than at Washington. In the Loop district, with the sun not more than 40° above the horizon, it averages only 60 per cent as intense. The illumination on a vertical surface facing 180° in azimuth from the sun, computed from the sky brightness measurements, averages only about two-thirds as intense as the illumination computed from similar measurements for Washington.

A method is given of combining computations of illumination on horizontal and vertical surfaces from sky brightness measurements with determinations of the shading effect of buildings or other objects. This makes it possible to compute for average sky conditions of the various types the illumination that results from exposure to any given portion of the sky at any hour of the day or season of the year.

The second paper, on *The mathematical equations for heat conduction in the fins of air-cooled engines*, by S. R. PARSONS and D. R. HARPER, 3D, was presented by Mr. Harper. It was discussed by Mr. HAWKESWORTH.

The communication included a very brief historical sketch and a discussion of the assumptions, both physical and geometrical, which must be necessarily made to bring the problem within possibility of solution. Then followed

the development of an expression for approximate fin effectiveness, based upon rather simple mathematics and very convenient in form for engineering use, the essence of this paper being an examination into the magnitude of the errors involved in using this expression without correction, and a determination of the corrections needed for accurate work, a process involving considerable mathematics quite outside the range of usual engine design practice.[1]

855TH MEETING

The 855th meeting of the Philosophical Society of Washington was held in the Cosmos Club auditorium, November 5, 1921. It was called to order at 8:15 p.m. by President FARIS. 48 persons were present.

The President called attention to the revised By-laws under which officers of the Society are now nominated and elected. The President announced that the Committee on Elections, consisting of Messrs. C. T. RUDE, *Chairman*, C. R. DUVAL, and IRWIN G. PRIEST, was present, and ready to receive nominations in writing for president, two vice-presidents, treasurer, corresponding secretary, and two members of the General Committee.

The first paper of the evening, on *The great tides in the Bay of Fundy, and their causes*, was presented by Mr. H. A. MARMER, and was illustrated. It was discussed by Messrs. CRITTENDEN, PRIEST, L. J. BRIGGS, WHITE, and STIMSON.

In the Bay of Fundy here occurs the greatest known rise and fall of the tide. In the upper part of this bay, in a period of six hours, the tide rises a vertical distance of from 40 to 50 feet, and in the following period of six hours it falls the same distance.

The Bay of Fundy is a funnel-shaped body of water with a gradually shoaling bottom from mouth to head, and it is to these features that the great range of the tide in the upper reaches of the bay has been ascribed, for it is well known that the concentration of the energy of motion of a large mass of water in a narrowing channel brings about an increase in the range of the tide. But this explanation does not account satisfactorily for an increase in the range from less than 10 feet at the mouth to more than 40 feet at the head.

On the southern shore of the bay the range of the tide increases from 9.1 feet at Cape Sable to 44.2 feet in Noel Bay. On the northern shore a similar condition prevails, the range of the tide increasing from mouth to head, and this increase becomes even more striking if one begins with the tide at Nantucket Island and goes up the coasts of Massachusetts, New Hampshire, Maine, and New Brunswick, which form the western and northern shores of the Gulf of Maine and the Bay of Fundy, the mean range at Nantucket being a little more than one foot and at Moncton 41.2 feet.

An examination of the ranges of the tide on the two shores of the bay brings out the fact that on the southern shore the range of the tide is greater than on the northern shore, this difference being due to the deflecting force arising from the rotation of the earth.

From a study of the times of the tide in the bay and of the relation of time of current to time of tide it develops that the tidal movement is of the stationary wave type, with the node at the mouth. In consequence of this

[1] See also the paper by the same authors in this JOURNAL 11: 409–416. October 19, 1921.

there is a gradual increase in the range of the tide from mouth to head. A further increase takes place in the upper reaches of the bay, because of the very considerable contraction in width and shallowing in depth.

By applying the formulas for stationary wave oscillation in a body of water open at one end, as developed by Harris and by Honda and his colleagues, the period of oscillation of the Bay of Fundy is found to approximate 12 1/2 hours or the period of the ocean tide. It may, therefore, be concluded that the tidal phenomena in the Bay of Fundy arise primarily from the fact that the period of oscillation of the water in the bay closely approximates the period of the ocean tide. This brings about a stationary wave movement of the water with the greatest possible rise and fall for the existing geographic features.

The second paper, on *Characteristic soft X-rays*, by F. L. MOHLER and P. D. FOOTE, was presented by Mr. MOHLER, and was illustrated. It was discussed by Messrs. L. J. BRIGGS, HUMPHREYS, TUCKERMAN, and CRITTENDEN.

The paper has been published in brief form in this JOURNAL.[1]

H. H. KIMBALL, *Recording Secretary*

SCIENTIFIC NOTES AND NEWS

The Horological Institute of America was formally organized at the offices of the National Research Council on October 20. One of its important purposes is to aid the jewelry trade in raising the standard of watch repair work, through a system of examination and certification in which samples of repair work on watches will be tested by the Bureau of Standards.

The Petrologists' Club met on November 16 at the home of H. G. FERGUSON, and discussed the following papers: C. N. FENNER: *Evidence of assimilation during the Katmai eruption;* N. L. BOWEN: *The alnoite rocks near Montreal.*

The non-magnetic ship *Carnegie* of the Department of Terrestrial Magnetism, Carnegie Institution of Washington, arrived at Washington on November 10, completing a two-year cruise around the world. The *Carnegie* left Hampton Roads in October, 1919, and has touched at points in western Africa, Argentina, South Africa, Ceylon, Australia, New Zealand, the southern Pacific islands, and Hawaii, returning by way of the Panama Canal. Capt. J. P. AULT was in command, and the rest of the scientific personnel consisted of Messrs. H. F. JOHNSTON, A. THOMSON, H. R. GRUMMANN, R. R. MILLS, R. PEMBERTON, and F. A. FRANKE.

The following educational courses are being given at the Department of Agriculture this winter: (1) H. C. TAYLOR, of the Department: *Agricultural economics;* (2) H. R. TOLLEY: *Statistical methods* (with special lectures by Messrs. MURRAY, ANDREWS, and HOLMES); (3) C. O. APPLEMAN, of the University of Maryland: *Biochemistry;* (4) L. R. JONES, of the National Research Council: *Plant pathology;* (5) B. E. LIVINGSTON, of Johns Hopkins University: *Plant physiology;* (6) SEWALL WRIGHT, of the Bureau of Animal Industry: *Genetics;* (7) W. J. HUMPHREYS, of the Weather Bureau: *Physics of the air;* (8) R. C. TOLMAN, of the Fixed Nitrogen Research Laboratory: *Statistical chemistry.* Special graduate courses are also being ar-

[1] This JOURNAL 11: 273–274. June 19, 1921.

ranged, the first of which is being given by E. T. WHERRY, of the Bureau of Chemistry, on *Advanced crystallography.*

The following Washington scientists have been appointed members of the technical staff of the American delegation to the Conference on the Limitation of Armament: Dr. L. W. AUSTIN, radio specialist of the Navy Department; Dr. J. H. DELLINGER, chief of radio investigations at the Bureau of Standards; Gen. AMOS E. FRIES, chief of the Chemical Warfare Service of the Army; Gen. GEORGE O. SQUIER, chief of the Signal Corps of the Army; Dr. S. W. STRATTON, Director of the Bureau of Standards.

Mr. CARL S. CRAGOE, who has been on a year's leave of absence and engaged in graduate study at Johns Hopkins University, has returned to the Bureau of Standards.

Mr. T. IKEGAMI, chief geologist of the Nippon Oil Company, visited the scientific institutions of Washington in November.

Dr. SYLVANUS G. MORLEY, research associate of the Carnegie Institution of Washington, delivered a public lecture at the auditorium of the Institution on the evening of November 15 on *The chronology of the ancient Maya.*

Miss EUNICE ROCKWOOD OBERLY, since 1908 librarian of the Bureau of Plant Industry, U. S. Department of Agriculture, died suddenly at her home in Washington on November 5, 1921.

Dr. JOHN AUGUSTINE ZAHM, of Holy Cross College, Brookland, D. C., died at Munich, Bavaria, on November 11, 1921, in his seventy-first year. Dr. Zahm was born at New Lexington, Ohio, June 14, 1851. He became a member of the Order of the Holy Cross in 1871, and was in charge of the scientific department of Notre Dame University, Indiana, from 1874 to 1895. He accompanied the late ex-President THEODORE ROOSEVELT on his Brazilian expedition. He was the author of a number of books and papers on evolution and on the geography and history of South America.

Correction: The JOURNAL was in error in stating in a news item, on page 448, that Dr. MERWIN PORTER SNELL, who died on September 23, 1921, was at one time connected with the Smithsonian Institution. He was an employee of the Bureau of Fisheries from 1882 to 1890.

ERRATA

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P. 45.....Footnote 4	read L. H. Adams, E. D. Williamson and J. Johnston, Jour. Am. Chem. Soc. **41**: 12–42. 1919.
P. 46.....Last item in column 4, table 1 should	read -0.02
P. 48.....In Equation (5), for +	read ×
P. 151.....7th line up from bottom—For x	read x_e
P. 153.....Equation (12) for f_o	read F_o
P. 301, line 12...For discoid	read disciform
P. 378.....553rd meeting, for March 21	read March 1

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